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DEFOLIATOR INFESTATIONS (OTHER THAN SPRUCE BUDWORM)

FOREST SERVICE REGION 4

November 1963

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BRANCH OF FOREST INSECT AND DISEASE
PREVENTION AND CONTROL

DIVISION OF TIMBER MANAGEMENT

Forest Service
U. S. Department of Agriculture
Ogden, Utah

DEFOLIATOR INFESTATIONS
(OTHER THAN SPRUCE BUDWORM)

FOREST SERVICE REGION 4

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INTRODUCTION

A great variety of defoliating insects are known to occur throughout the territory included in U. S. Forest Service, Region Four. Undoubtedly, in the past most of them have developed into epidemic populations at one time or another. Until recently, entomologists and land managers paid little or no attention to defoliators except where commercial stands or areas under intensive management, such as National Parks, were affected.

Within the last few years, most forest lands have come under a more intensive resource management program. Consequently, many of the defoliating pests that were practically ignored in the past, are now considered in a more serious light since their hosts have increased in value.

Some of the defoliator infestations discussed in this report are new, others are old, having been epidemic for fifteen years or more. The effect of defoliators in commercial forest areas is primarily an impact on growth although in some cases tree mortality occurs. Defoliators in recreational areas adversely affect the asthetics and in picnic and camping areas often destroy the only available shade. Trees to be used for Christmas trees are rendered unfit for sale by defoliation. Extensive defoliation of browse species may affect big game populations. Other resource values can also be adversely affected by epidemics of defoliating insects.

It is the purpose of this report to present the entomological interpretations of the more serious defoliating infestations, other than the spruce budworm, occurring on forest and range lands of all ownerships in the states of Utah, Nevada, the western half of Wyoming, and the southern two-thirds of Idaho. In evaluating current defoliator conditions, entomologists have endeavored to consider all factors pertinent to any given infestation, and to utilize this information in predicting present status, immediate or potential damage, and possible course of the infestation.

This report is divided into two sections. The first section covers defoliating insects affecting deciduous trees and shrubs. The second section covers defoliating insects affecting coniferous species. State maps showing relative locations of the various outbreaks are appended.

INSECTS AFFECTING
DECIDUOUS TREES AND SHRUBS

(Insects discussed in this section)

Aspen Leaf Tier
Fall and Spring Canker Worms
Tent Caterpillars
Tussock Moth
Aspen Leaf Miner
Sheep Moth
Aphids
Anacamptodes clivinaria (Guenee)
Sagebrush Defoliator
Boxelder Defoliator

Aspen Leaf Tier

The aspen leaf tier, Sciaphila duplex (Wlsh.), has been epidemic in some aspen stands in Region Four since 1961. In 1962, the infestation covered over 300,000 acres and occurred in commercial stands, recreation areas, and game ranges. In 1963, the total infested acreage decreased to about 150,000 acres. The leaf tier population on the Bridger National Forest was reduced by natural causes to a low level. Acreage and intensity of damage decreased noticeably on the Wasatch National Forest also. Epidemic conditions persist in many of the infestations on the Dixie, Fishlake, and Cache National Forests. In some infestations epidemic numbers of the large aspen tortrix, Choristoneura conflictana (Wlk.), are also present. This insect works much the same as the leaf tier. Its presence complicates evaluations.

Approximately 75,000 to 100,000 acres were infested on the Fishlake National Forest, a sizeable decrease from the 1962 infestation. Within the areas infested, however, the populations of both the leaf tier and large aspen tortrix were sufficient to cause heavy defoliation. In Sheep Valley, Deer Creek,and Big John Flat, defoliation ranged from 80 to 100 percent. Dipterous and Hymenopterous parasites were numerous in most infested areas. It is expected the general down trend of these aspen defoliators will continue in 1964.

On the Dixie National Forest leaf tier-tortrix infestations covered nearly 50,000 acres. Major infestations occurred southeast of Cedar City, Utah, in the Red Desert area near Duck Creek Ranger Station, and in nearly all aspen stands from Sugar Loaf Mountain north to Bear Valley. Defoliation was 100 percent throughout the Red Desert infestation. Elsewhere on the Dixie National Forest defoliation ranged from 25 to 100 percent. It is expected the infestation on the Dixie National Forest will show general downward trend in 1964.

There are two small areas of infestation, both less than 1,000 acres in size, on the Cache National Forest. These are located (1) in Snow Basin east of Ogden, Utah, and (2) in Stauffer Co-op Basin Georgetown, Idaho. The infestation maintained itself at about the same size as in 1962. Defoliation ranged from 25 to 35 percent. The infestation is expected to continue at its present level in 1964 with a possibility of a slight decreasing trend.

In summary, there are indications of declining populations of the leaf tier in over half of the infestations. It is possible that leaf tier populations will continue to be epidemic in Sheep Valley, Big Jones Flat, on the Fishlake National Forest and in the Red Desert area of the Dixie National Forest, but the overall picture points toward a general downward trend of leaf tier populations.

Fall and Spring Canker Worms

An epidemic outbreak of fall and spring canker worms, Alsophila pometaria (Harris) and Paleacrita vernata (Peck), defoliating boxelder, maple, and mountain ash, in Mill Creek Canyon on the Wasatch National Forest has been active for the last three years. Mill Creek Canyon is a heavily used recreation area just east of Salt Lake City, Utah. This area was partially sprayed with malathion by jeep-mounted mist blower in 1961 and 1962. Complete coverage was impossible and the trees in the canyon bottom were reinfested each year. In 1963, the infestation was sprayed with malathion by helicopter. Spray coverage was good but dosage was light. Nevertheless, the insect mortality in all areas sampled exceeded 90 percent and noticeable defoliation was prevented throughout the canyon. It is possible, however, that light mortality could have occurred in small isolated spots. Therefore, careful examination of the Mill Creek Canyon area in 1964 will be necessary to determine the likelihood of reinfestation.

Great Basin Tent Caterpillar

The Great Basin tent caterpillar, (Malacosoma fragile Stretch), occurred at an epidemic level in the spring of 1963 in Zion National Park and along the Virgin River in southern Utah. Aspen, cottonwood, and several brush and browse species along the river bottom were 70 to 100 percent defoliated. A program was initiated by Zion National Park to control the tent caterpillar with the bacterial insecticide, Bacillus thuringiensis Berliner. Control was effective and insects were killed before hosts were seriously defoliated. The epidemic trend is expected to continue in 1964, and it is likely additional control efforts will be needed in Zion National Park.

The tent caterpillar infestation discovered in 1962 was again epidemic on approximately 3,000 acres of bitterbrush in Grand Teton National Park. Heaviest tent caterpillar populations were concentrated near Jackson Airport. Defoliation ranged from 40 to 80 percent. Tent caterpillars were also epidemic on bitterbrush and various other shrubs in the Hoback River drainage of the Teton National Forest.

An outbreak of tent caterpillars was detected in 1963 on about 2,000 acres of sagebrush and bitterbrush type along the Middle Fork of the Boise River, east of Featherville, Idaho. Bitterbrush was the host, and defoliation varied from 50 to 75 percent. This infestation is expected to continue at its present level at least through 1964.

This pest has shown a general increasing trend and undoubtedly there are many more unreported localized outbreaks of the Great Basin tent caterpillar throughout the Region. The increasing trend is expected to continue at least another year.

Tussock Moth - Reno, Nevada

Populations of tussock moths defoliating bitterbrush are again active near Reno, Nevada. In 1959, a polyhedral virus was applied to infested bitterbrush in this area and the tussock moth population was reduced to a low

level. However, the insects started to increase again in 1961 and 1962. Viable egg masses were relatively abundant at the base of bitterbrush plants within the control area.

An examination of the infested area during May 1963, when tussock moth egg masses were just starting to hatch, showed larval density would be sufficiently high to cause severe defoliation. Forced rearing of tussock moth egg masses collected from the infested area in 1962 confirmed the presence of the native virus. The effect this virus had in exerting a controlling influence on the 1963 population is not known at this time, however, it is expected the virus will reduce the tussock moth population as the larvae reach epidemic densities.

Aspen Leaf Miner

There was no apparent decrease in 1963 in the aspen leaf miner, Phyllocnistis populiella Chamb., epidemic that has persisted for many years throughout southeastern Idaho and western Wyoming. Considerable tree deformity and growth reduction has occurred in the past few years. Increased activity of the pest was noted in many aspen stands throughout Utah during 1963. However, no epidemic infestations were detected.

Sheep Moth

Concentrations of adult sheep moths, Pseudohazis sp., were observed flying in the Crow Creek drainage of the Caribou National Forest in Idaho. No serious defoliation of the host plants snowberry and honeysuckle was observed. Adult moths were collected in Logan Canyon, Utah, on the Cache National Forest. Defoliation of herbaceous plants within the infested areas is expected to continue and be somewhat more severe in 1964.

Aphids

Aphid populations were heavy in 1963 on aspen around Fish Lake on the Fishlake National Forest. Infested leaves were sticky from the copious flow of honeydew. Feeding caused noticeable leaf deformity which caused a majority of the leaves to drop in July. The infestation was not widespread and will probably be short-lived.

Anacamptodes clivinaria (Guenee)

A geometrid, identified as Anacamptodes clivinaria (Guenee), has been epidemic on mountain mahogany on Bureau of Land Management lands in Owyhee County, Idaho for at least two years. Approximately 10,000 to 15,000 acres of mountain mahogany were defoliated in the Juniper Mountain area in 1963. Considerable tree mortality has occurred on about 20 acres in the center of the infested area. In addition, there are many dead trees scattered throughout the infestation that apparently have been killed by this defoliating insect. Pupal density counts showed 2 to 52 pupae per square foot of duff with an average of 12.4 per square foot. In areas where past defoliation has been heavy, pupal population was low, averaging three per square foot. The low pupae counts in these areas may have been

due to lack of foliage which caused the larvae to move to new areas or die before reaching pupal stage. In areas defoliated lightly last year, but heavily defoliated this year, pupal counts averaged 18.4 pupae per square foot. In spite of the fact that present pupal density is less than half of that reached the prior year, this infestation is expected to be epidemic in 1964 and it is quite possible additional areas may be defoliated the coming summer. While the pupal density indicates the larval population may be somewhat lighter in most areas, it is expected many additional trees will be killed since they are presently in a weakened condition.

In cooperation with a graduate student at Utah State University, laboratory tests will be conducted this winter (1963-64) to determine an effective insecticide for the control of this insect.

Sagebrush Defoliator

A severe infestation of a sagebrush defoliator, identified as Aroga websteri (Clarke), was discovered in the summer of 1963 south of Twin Falls, Idaho and west of the Salmon Creek Reservoir near Rogerson, Idaho. An area of approximately 5,000 to 6,000 acres of sagebrush on State, Private, and Bureau of Land Management lands was defoliated in 1963. Some plants were heavily defoliated. Evaluations to determine brood density and parasitism rates will have to be made before the infestation trend can be established. Aroga websteri (Clarke) is expected to continue at its present high level of activity and the general trend points toward an increase in the size of the infested area.

In the Intermountain Region infestations of Aroga websteri have occurred periodically in the past. In the last ten years several thousands of acres of sagebrush have been denuded or heavily damaged by these outbreaks.

Other outbreaks may occur within the Intermountain Region. Sizeable outbreaks of this pest are now present in southeastern Oregon on Bureau of Land Management lands near the Idaho border.

Boxelder Defoliator

An unidentified defoliator caused heavy defoliation in boxelder along the Ogden and Weber Rivers near Ogden, Utah. Defoliation ranged from 50 to 100 percent. Pupae were collected and reared through to adult stage. Adult moths were sent to the Agriculture Research Service, Washington, D. C., for identification. Pupal density counts were high and increased defoliation is expected to occur the coming summer.

Defoliation of boxelder, probably caused by the same insect, occurred along the Logan River and along the Black's Smith Fork River south of Logan, Utah.

INSECTS AFFECTING CONIFERS

(Insects discussed in this section)

Lodgepole Needle Miner
Pine Needle Scale
Pine Tube Moth
Tussock Moth
Pandora Moth
Mealybugs
White Fir Needle Miner
Scale in Pinyon Pine
Spittlebugs
Aphids

Lodgepole Needle Miner

Epidemic populations of Recurvaria milleri Bursk, the lodgepole needle miner, are present in lodgepole pine stands of the Ashley and Targhee National Forests.

The infestation on the Ashley National Forest has been active for about five years. The infestation is centered around Greendale Junction, southwest of the Flaming Gorge Recreation area. The number of infested acres has decreased since 1962. Defoliation in 1963 varied from medium to heavy on less than 5,000 acres. The overall damage has not been severe to date. From all indications, the trend of the infestation on the Ashley National Forest is downward.

Epidemic infestations of the lodgepole needle miner have been present on the Targhee National Forest for the last seven years. Over 100,000 acres were infested in 1962. This year (1963) only about 10,000 acres were defoliated to the extent damage was visible from the air. A spot infestation of about 300 acres was located adjacent to Sheridan Reservoir. Defoliation ranged from 75 to 85 percent. This infestation will probably increase in size next summer. Approximately 100 acres of lodgepole pine were infested with needle miner in Bear Gulch north of Kilgore, Idaho. Defoliation here varied from 35 to 50 percent. Three budworms Choristoneura pinus Freeman, C. Lambertiana (Busck) and a Dioryctria are present in the Bear Gulch infestation as well as needle miner.

The largest infestation occurred north of Bishop Wells and west of Island Park Reservoir. Aerial observers estimate approximately 2,600 acres of lodgepole pine were defoliated. Defoliation appeared heavy from the air. Ground evaluations were not made in this infestation, consequently percent of defoliation and intensity of needle miner population is not known. Evaluations are planned in this area early next summer.

Some areas have had repeated heavy defoliation for two or more years. It is quite possible the sizeable decrease in acreage receiving noticeable defoliation may represent the start of a down trend for the needle miner population on the Targhee National Forest. However, since the intensity of defoliation caused by the needle miner has varied year to year, intensive on-the-ground evaluations next summer will be necessary to determine the exact status of these infestations.

Pine Needle Scale

Infestations of the pine needle scale, (Phenacaspis, pinifoliae (Fitch)), on lodgepole pine, Douglas-fir, and true fir have increased the past few years in the Region. Feeding by scales caused 70 percent defoliation of lodgepole pine, east of Ketchum, Idaho and in localized areas near Island Park, Idaho.

A coccinellid predator, (Exochomus aethiops Bland), was found feeding on the scale infesting lodgepole pine. Infested areas will be ground checked the coming spring to determine their current status and to assess the success of the ladybird beetle predator in reducing the scale population.

Tube Moth

Infestations of the pine tube moth, Argyrotaenia pinatubana Kearf., were first detected on the Targhee National Forest in 1961. The amount of defoliation has decreased yearly. No major change in defoliation pattern was noted in 1963 but acreage infested decreased. Heaviest damage was recorded near the southwest end of the Island Park Reservoir near Pond's Lodge, Idaho. An additional decrease in the size of the infested area is expected next year.

Tussock Moth

Douglas-fir stands in the Silver City, Idaho and South Mountain areas of Owyhee County, Idaho, are being defoliated by tussock moths. These infestations have a long history of epidemics developing periodically, and then being brought under control by a native virus. Ground evaluations in the fall of 1963 showed approximately 4,000 acres were heavily defoliated, with medium to light defoliation on about 12,000 acres. The heavy defoliations occur in widely scattered areas. In these areas the trees have been heavily defoliated in the lower half of the crown and the upper half nearly completely stripped of needles. Throughout the infestation heaviest defoliation occurred on 1963 growth.

Many dead tussock moth larvae suspected to be virus killed were observed on the foliage of infested trees throughout the area. Laboratory examination of the dead larvae confirmed the presence of the native virus. Virus counts were high averaging 483,730 polyhedral bodies per dead tussock moth larvae. In general, egg mass counts were low. Egg masses were collected for laboratory rearing to determine parasitism and to measure expected larval density. The tussock moth infestation is expected to decline rapidly, as the virus takes over, and in all probability will be at a low level within two years.

Epidemic populations of the Douglas-fir tussock moth, (Hemerocampa pseudotsugata McD.), defoliating white fir stands on the Humboldt Division of the Humboldt National Forest near Jarbidge, Nevada appear to have been controlled by egg parasites and a native virus that caused considerable larval mortality. This tussock moth outbreak began in 1960, and gained sharply in 1962, but evaluations that fall led to a prediction of a decided drop in the population level. Ground evaluations in 1963 showed the prediction accurate with tussock moth oviposition low and very few viable egg masses present. The decreasing trend is expected to continue through next year.

In 1962, Boise National Forest personnel reported Douglas-fir stands being defoliated in the Dutch Creek-Swanholm Creek area along the Middle Fork of the Boise River. Ground checks showed that the Douglas-fir tussock moth, (Hemerocampa pseudotsugata McD.), was causing the damage. Approximately 5,000 acres were heavily defoliated and over 8,000 acres were classed as moderately to lightly defoliated.

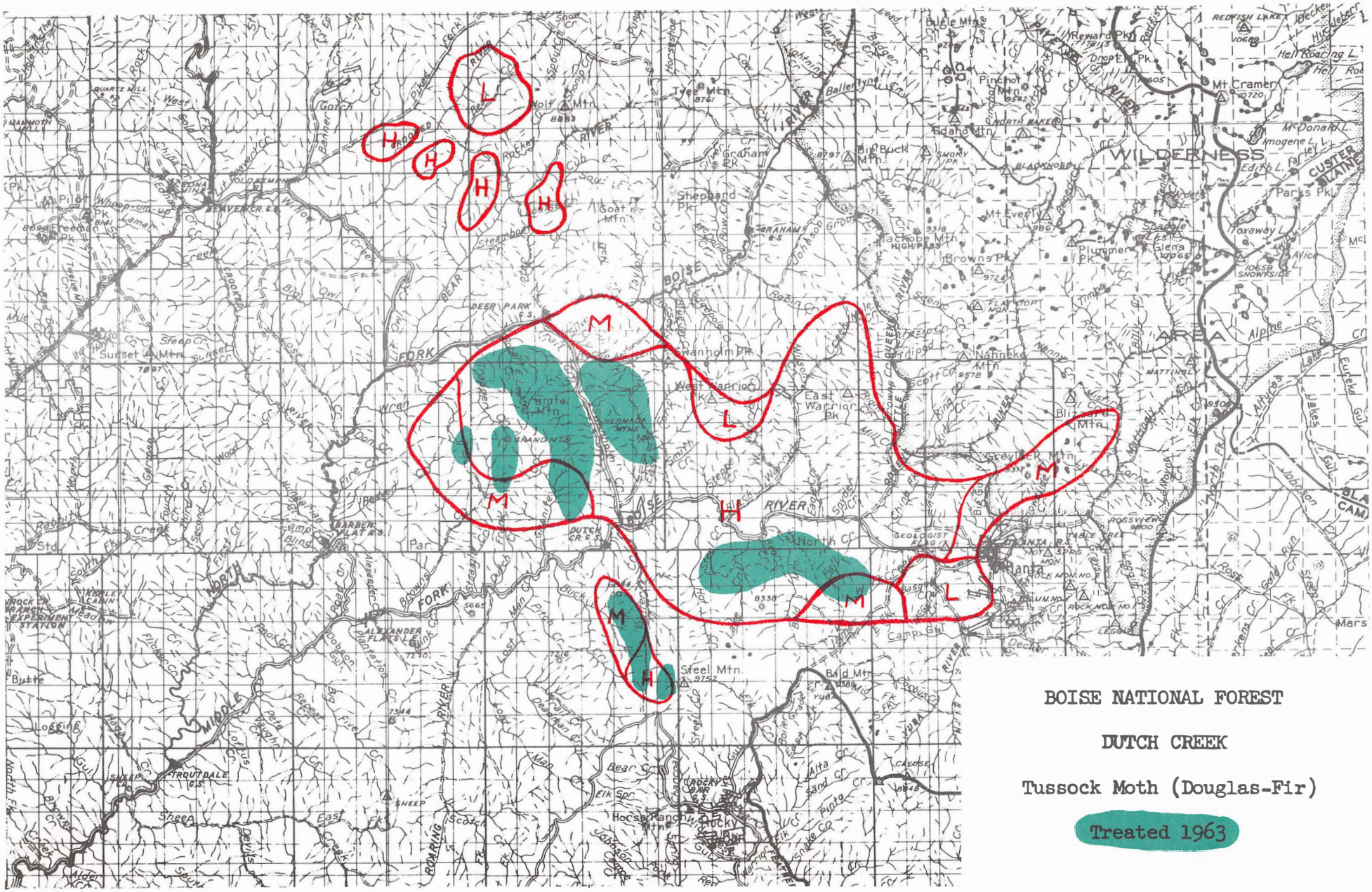
Suppression action was recommended and during June 1963, 12,575 acres were aerially sprayed with a polyhedral virus. This host specific material

appears to have effectively reduced the tussock moth populations in the sprayed areas to a tolerable level.

During the course of the tussock moth control project, it was discovered that light populations of tussock moth larvae were present on many thousand acres outside but adjacent to the control boundaries. Boise National Forest personnel reported new areas of tussock moth activity in the Crooked River, Bear River, and Louise Creek areas just north of the known infestations and during fall aerial insect detection flights, observers detected several extensions of the reported infestations. At the present time it appears that tussock moths are infesting over 60,000 acres of Douglas-fir stands on the Boise National Forest.

Moth populations and Douglas-fir defoliation outside the control boundaries are not expected to cause extensive damage enough to justify a control program in 1964.

The extent to which the virus may spread outside the control boundaries will not be known until evaluations have been completed next fall (1964). However, virus spread is expected as the tussock moth population increases in the infestation immediately adjoining the sprayed area. It is unlikely, however, that the virus will spread into all infested areas. Therefore, if the tussock moth populations continue to increase in unsprayed areas to a point where damage becomes intolerable, it may be necessary to innoculate these areas by aerial application of virus. The following map shows the areas treated in 1963 and the present boundaries of the known infestations.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BOISE NATIONAL FOREST
DUTCH CREEK
Tussock Moth (Douglas-Fir)
Treated 1963

Pandora Moth

In 1959, a severe infestation of pandora moth, (Coloradia pandora Blake), was detected in lodgepole pine stands on the north side of the Ashley National Forest. The infestation increased in size from 15,000 acres in 1959 to 67,000 acres in 1962. In 1961, it was predicted the pandora moth infestation would start a down trend in 1962 and continue until the population reached a low level. In 1962, an average of 1.16 viable pupae per square foot of soil was found before adult emergence. This compared with an average pupal density of 8.7 per square foot found in 1960.

Evaluations by entomologists in 1963 showed only a very few defoliated lodgepole pine. No larvae were found.

The infestation is expected to remain at a low level for at least the next few years.

Mealybugs

The mealybug, Puto cupressi (Coleman), has been epidemic on the Payette National Forest north of McCall, Idaho since 1957. The preferred host is alpine fir, however, white bark pine, and to a lesser degree, Engelmann spruce and lodgepole pine are also attacked. The outbreaks have followed a pattern of developing in a drainage, persisting for two or more years, then almost dying out, only to reappear in an adjacent drainage. Whenever heavy mealybug populations have persisted for three or four consecutive years, some alpine fir trees have been killed.

At present slightly more than 14,000 acres are infested with epidemic populations of the mealybug just north of Big Hazard Lake on the New Meadows District. A small spot infestation is also present north of Marshall Mountain on the Warren District. It was not possible to evaluate these infestations this fall, therefore, their potential and trend is unknown. No practical methods for controlling or reducing mealybug populations in coniferous forests are known.

Approximately 60,000 acres of Engelmann spruce stands continue to carry infestations of the spruce mealybug, Puto sp., on the Griffin and Barney Top on the Dixie National Forest, and Thousand Lake Mountain on the Fishlake National Forest. The mealybugs were first reported on the Fishlake National Forest in 1939, and on the Dixie National Forest in 1955.

No noticeable increase in size of infested area and no decrease in severity of damage was observed in 1963. The mealybugs gave birth to living young on Griffin Top and on the north end of Thousand Lake Mountain, which resulted in a definite population increase this year. For the same reason the mealybug populations on the Barney Top and on the south end of Thousand Lake Mountain also will probably increase in 1964. Feeding by these insects could result in additional limb killing and mortality of young spruce.

No practical methods are known for reducing the mealybug populations in these high altitude spruce stands.

White Fir Needle Miner

A definite increase in populations of the white fir needle miner, (Epinotia meritana Hein.), occurred on the Dixie National Forest and in Bryce Canyon National Park in southern Utah in 1963. The infestation was detected by Dixie National Forest personnel in Blubber Creek in the East Fork drainage of the Sevier River. An epidemic infestation of the needle miner occurred in the same general vicinity from 1952 through 1957. In 1957 to 1958, the infestation subsided primarily because of hymenopterous parasites. A pilot control test was initiated in Bryce Canyon National Park on about 2,000 acres in 1957, which accelerated the reduction of the needle miner population.

Biological evaluations in the area late in the summer of 1963 showed an average of slightly over 14 needles per six-inch twig had been mined. Some mined needles undoubtedly had dropped to the ground. On the basis of past experience, it is known that each larva usually mines an average of seven needles per year. While the present population density (about two larvae per needle) does not represent an epidemic population, the population more than doubled over last year, indicating a definite increasing trend. It is difficult to evaluate the fir needle miner in the fall, consequently, evaluations will be made in early spring 1964 when more reliable data can be collected.

Scale in Pinyon

A scale, Matsucoccus acalyptus Herbert, has been causing increased damage to pinyon pine stands in Nevada and southern Utah for the past seven to eight years. Altogether, there are several hundred thousand acres of pinyon pine supporting epidemic populations of the scale. In 1963, the scale was found to be epidemic in nearly all areas which had been infested previously. Needle shedding was prevalent, and in some areas many of the smaller trees were dead. A relatively new infestation near Panguitch, Utah, increased from 5,000 acres to 7,000 acres in 1963. In the area where the infestation originated, defoliation was lighter than the previous year. However, defoliation ranged from 40 to 80 percent throughout the remainder of the infestation. It was not possible to examine this infestation in 1963, consequently, no prediction of trend can be made.

Spittlebugs

An area of approximately 500 acres of juniper was infested with an unidentified spittlebug in Bear Valley on the Dixie National Forest in 1963. Four or five insects per 15-inch branch were found. Feeding by the spittlebug caused some branch mortality. Further evaluations will be necessary to determine extent of damage, and to predict the trend of the outbreak.

A spittlebug outbreak in planted lodgepole pine was discovered by Ogden Ranger District personnel on the Cache National Forest. This outbreak was confined to young recently planted lodgepole pines in the Anderson Cove Picnic area on the south side of Pineview Reservoir. There are few naturally occurring trees around the reservoir so it is important to protect

the planted trees against loss from insects. Control with Malathion was recommended and used successfully to reduce the spittlebug infestation below the damage level.

Aphids in Ponderosa Pine

In 1963 an area of approximately 5,000 acres of ponderosa pine on the North Slope of the Ashley National Forest near Greendale Junction, Utah, was damaged by unidentified aphids. Defoliation averaged 30 percent. Smaller trees were heavily defoliated. Feeding by the aphids caused reddening and flagging of the tips of the branches. Evaluations in 1963 showed defoliation to be about the same as the previous year. Aphid populations were still heavy on ponderosa pine, and from all indications the outbreak will continue at least another year at the present epidemic level.

DISCUSSION

Epidemic populations of various defoliating insects were present within the Region Four area of the U. S. Forest Service in 1963. Damage was widespread in many stands, but confined to localized areas in others. Defoliation occurred on a variety of conifers, broadleaf trees and brush species.

Some direct control measures were necessary. A polyhedral virus was applied by fixed-wing aircraft to 12,575 acres of Douglas-fir on the Boise National Forest to reduce an epidemic population of tussock moth. A Great Basin tent caterpillar outbreak was successfully controlled by the use of Bacillus thuringiensis in Zion National Park.

From the entomological viewpoint control would have been justifiable on some of the other serious infestations. There is much to learn about the life histories and habits of many of the pests, and sampling methods must be developed before control can be attempted. For the most part, however, current populations are such that direct control measures will not be urgently needed next year.

Most of the damage from defoliators is from loss of growth and reduced vigor of host species. Some tree mortality has occurred in aspen stands where trees have been severely defoliated by the aspen leaf tier for more than two years. Tussock moths in the recent past killed large amounts of white fir and browse species, and in 1963 some Douglas-fir trees in Owyhee County, Idaho were killed.

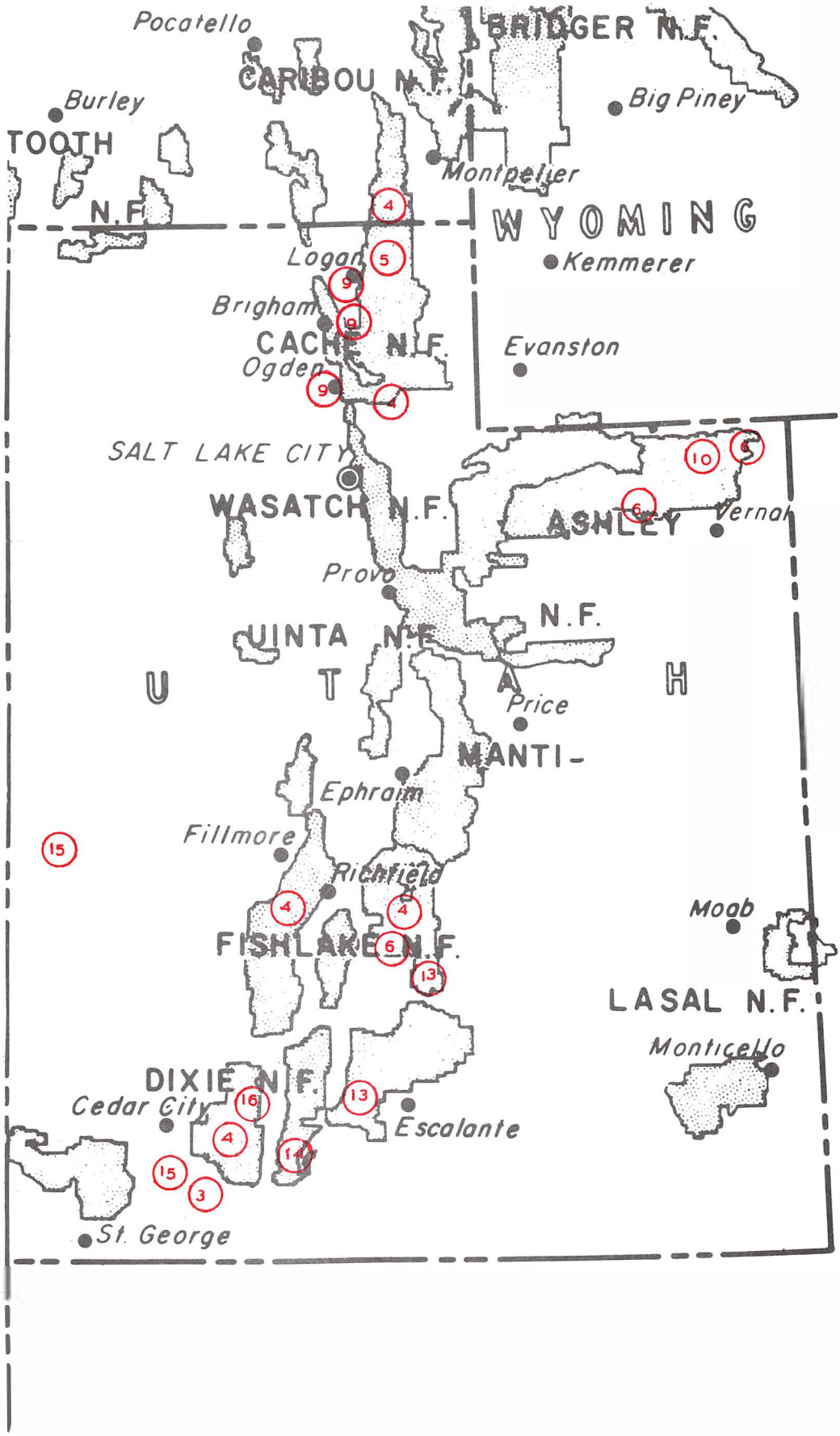
Although defoliators do not always kill trees outright, they cause a constant drain on our resources. As the management of the forest and range resource becomes more intensive, this drain increases in importance.

Laboratory rearing through the winter will provide additional information on defoliating insects and some of their related environmental factors.

Land managers will be notified as promptly as possible of any major changes that occur.

KEY TO DEFOLIATOR INFESTATIONS

	Insect	Host
1.	Aspen leaf tier	Aspen
2.	Fall and spring cankerworm	Boxelder, maples and ash
3.	Tent caterpillars	Bitterbrush
4.	Aspen leaf miner	Aspen
5.	Sheep moth	Honeysuckle and snowberry
6.	Aphids	Ponderosa pine
7.	*Anacamptodes clivinaria* (Guenee)	Mountain mohogany
8.	Sagebrush defoliator	Sagebrush
9.	Boxelder defoliator	Boxelder
10.	Lodgepole pine needle miner	Lodgepole pine
11.	Pine needle scale	Lodgepole pine
12.	Pine tube moth	Lodgepole pine
13.	Mealybug, *Puto* sp.	Engelmann spruce
14.	White fir needle miner	White fir
15.	Pinyon pine scale	Pinyon
16.	Spittlebugs on juniper	Juniper
17.	Mealybug, *Puto cupressi* (Ehrh.)	Lodgepole pine and alpine fir
18.	Tussock moths	Douglas-fir, white fir, bitterbrush, and ceanothus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Brigham
CACHE N.F.
Evanston
Ogden
SALT LAKE CITY
WASATCH N.F.
ASHLEY
Vernal
Provo
UINTA N.F.
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Price
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Ephraim
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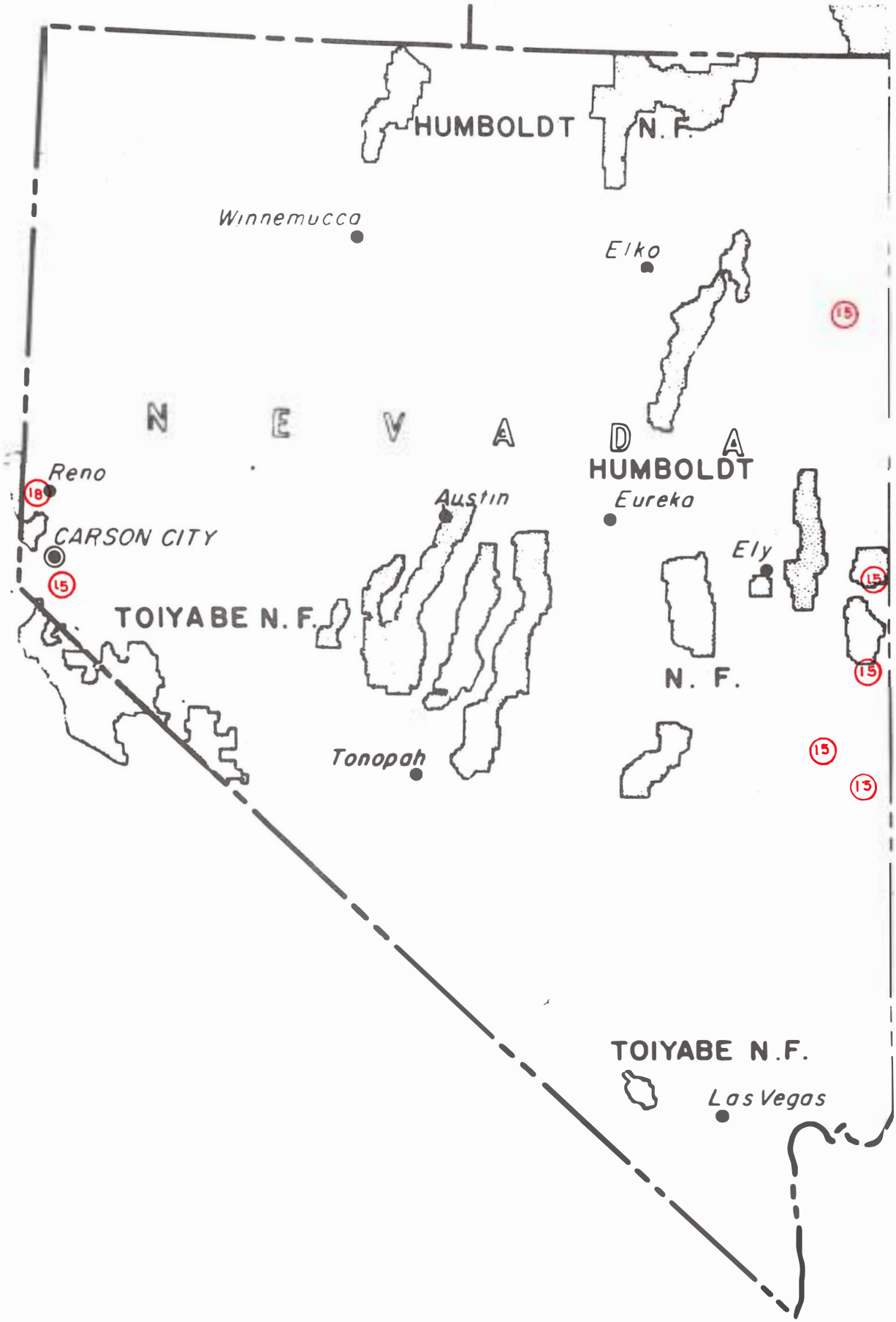
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Winnemucca
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HUMBOLDT
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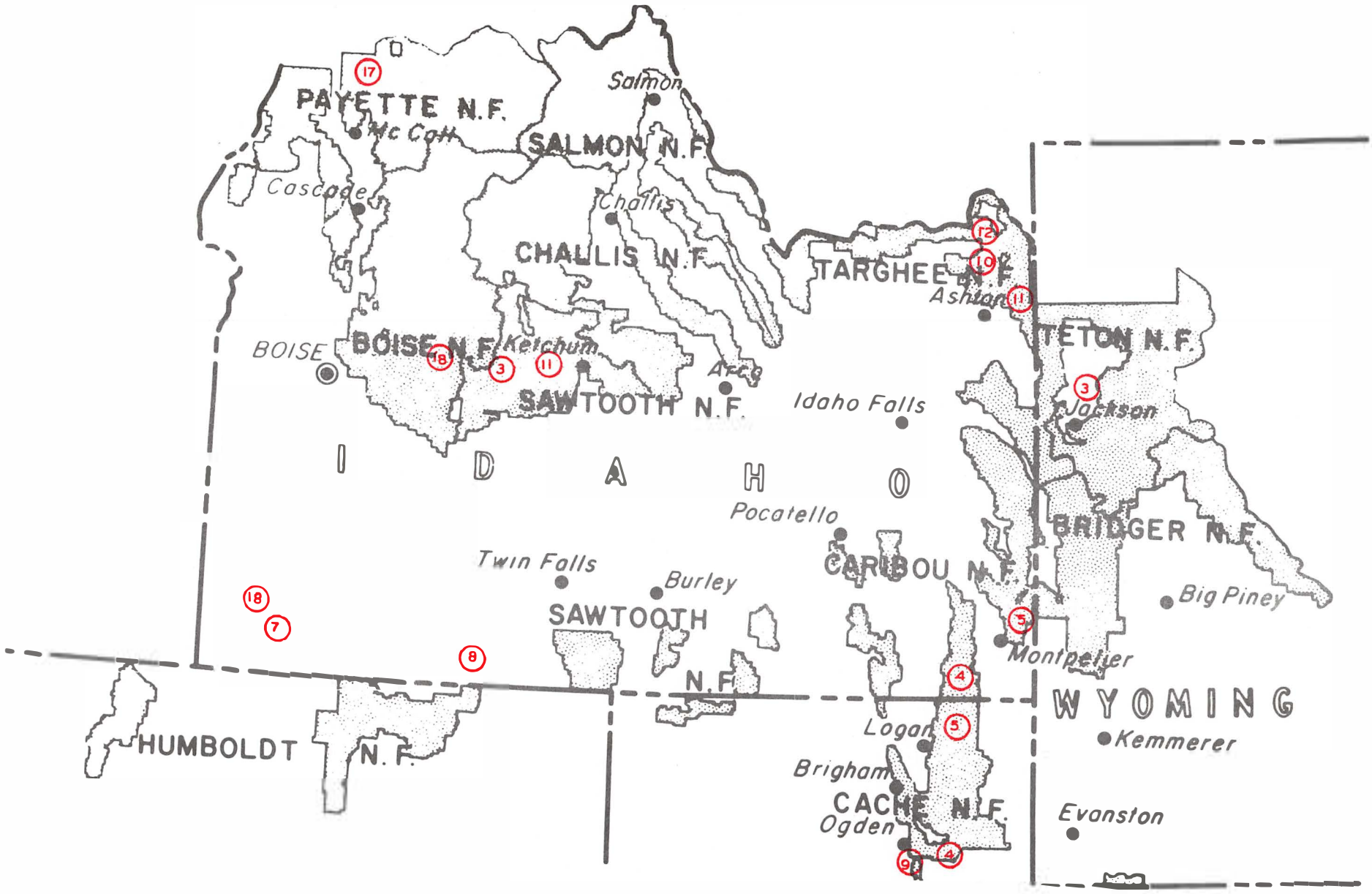
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Ketchum
Arco
SAWTOOTH N.F.
Idaho Falls
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Pocatello
BRIDGER N.F.
Big Piney
Twin Falls
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SAWTOOTH
N.F.
Montpelier
WYOMING
Logan
Kemmerer
Brigham
CACHE N.F.
Ogden
Evanston
HUMBOLDT N.F.